JAN McLIN CLAYBERG
PATENT AND TECHNICAL TRANSLATION

JAN McLIN CLAYBERG*
OLAF BEXHOEFT**

CERTIFIED BY AMERICAN TRANSLATORS ASSOCIATION
*GERMAN AND FRENCH TO ENGLISH
**ENGLISH TO GERMAN

5316 LITTLE FALLS ROAD
ARLINGTON, VIRGINIA 22207

TELEPHONE (703) 533-0333
FACSIMILE (703) 533-0334
JANCLAYBERG@YAHOO.COM

March 29, 2005

DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/DE2003/002781, filed on 08/21/2003, and published on 04/15/2004 under No. WO 2004/031873 A1, and amended claims 1 and 44.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

Olaf Bexhoeft

Olaf Bexhoeft
5316 Little Falls Rd.
Arlington, VA 22207-1522

Specification

Method and Devices for Automatically Supplying Material to a Processing Machine

The invention relates to a method and to devices for the automatic material supply to a processing machine, in particular supply of a printing press with rolls, as well as to a control system and a print shop with a control system in accordance with the preambles of claims 1, 22, 25, 44 or 46.

An automatic installation for inserting rolls into the roll supports of a printing press is known from DE 39 10 444 C2, wherein the logistics in respect to the rolls are provided by a control system assigned to this installation.

A method and a device for handling paper rolls is known from DE 43 39 234 A1, wherein the rolls are managed by a control system of a storage device and are conveyed by means of a transport system. Upon the request for a fresh paper roll by a printer, the data regarding size and quality input by the printer are provided to the control system and the transport carriage.

DE 44 16 213 A1 discloses an installation for storing and placing paper rolls, wherein a central control computer of the roll supply installation receives data regarding paper rolls from a data acquisition device and is in contact with a control console computer and/or a higher-order computer of a work preparation unit.

DE 43 28 036 A1 shows a device or a method for material supply, with a storage and a transport system, wherein the transport system is controlled from a central computer. The central computer is in contact with a control console

computer and, if required, with a central logistic computer, which controls the operations of all printing presses of the print shop and wherein monitoring of the stock of rolls in storage takes place.

The object of the invention is based on providing a method and devices for the automatic material supply of a processing machine, as well as a control system, and a print shop with a control system.

In accordance with the invention, this object is attained by means of the characteristics of claims 1, 22, 25, 44 or 46.

The advantages to be gained by means of the invention consist in particular in that a production is possible which is free of errors to a large extent. Errors, as well as delivery delays because of human failure and wrong decisions in particular, have been excluded to a large degree. Furthermore, the available rolls - in particular also rolls which have been started - can be used as economically as possible in the production. Furthermore, savings in personnel can also be achieved.

Moreover, the storage facility can be minimized and the ordering process can be automated. In further development, the logistics system is in contact with a production planning system in such a way that it is already possible in an early phase to detect possible deficits in the stock at hand, and the production can either be changed or a delivery can be arranged as fast as possible.

In contrast to solutions where, for example, requests for estimates of a need for rolls come from the printer, the concept assures the highest degree of dependability,

flexibility and effectiveness. The data already existing for other purposes - for example for product planning or planning the configuration of the printing press - and stored in the appropriate data processing unit are made accessible to an otherwise independent control system. This has been designed with its own "intelligence" and it conceptualizes the roll logistics on the basis of the received data. The access of the control system to actually existing data increases the dependability and flexibility further.

Exemplary embodiments of the invention are represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a schematic representation of a print shop with a printing press and a roll supply system,

Fig. 2, a schematic representation of a possible path of a roll through the roll supply system,

Fig. 3, a process-related representation of the roll supply,

Fig. 4, a data flow-related representation of the roll supply,

Fig. 5, a first exemplary embodiment for the physical connection of the material flow system,

Fig. 6, a second exemplary embodiment for the physical connection of the material flow system,

Fig. 7, a third exemplary embodiment for the physical connection of the material flow system,

Fig. 8, a fourth exemplary embodiment for the physical connection of the material flow system.

A business processing or treating webs, for example a print shop in accordance with Fig. 1, has for example at least one processing machine 01 which processes and/or treats webs, for example a printing press 01, a material supply system 02, for example a roll supply system 02, as well as a product planning system 03, if required. Moreover, it has a control system 05 designed as a material flow system 05 for coordinating and assuring the supply of rolls to the production process.

The printing press 01 has at least one unit 04, embodied as a printing unit 04 and/or printing tower 04, for imprinting a web, which is supplied with material, for example paper, by at least one unit 06 embodied as a roll changer 06 (roll changer for a stopped press or roll changer for roll changing at full press speed). The printing press 01 can furthermore contain a unit 07 located downstream of the printing unit 04 for processing the imprinted web, for example at least one folding apparatus 07. The at least one printing unit 04, the at least one roll changer 06, and possibly the at least one folding apparatus are connected via at least one signal line 09, for example an internal printing press network 09, with at least one operating and computing unit 08, for example a control console with a PC.

As a rule, several (for example five or even more) roll changers 06 are employed together for a folding apparatus 07 for a production process. This combination, together with the associated printing units 04, or printing towers 04, is called a section A, B. A line of presses consists for

example of several sections A, B, on each of which different production processes can be performed.

In the example represented in Fig. 1, the printing press 01 by way of example has two sections A, B, each with two printing towers 04, three roll changers 06, three operating and computing units 08, as well as one folding apparatus 07 per section A, B. In the embodiment in accordance with Fig. 1, the roll changers 06, as well as the printing units 04 of each section, are connected with each other via the network 09. A connection exists between the sections A, B and/or the operating and computing units 08 via the network 09 (homogeneous or heterogeneous). The folding apparatus 07, if provided, are also in connection with this network 09.

The operating and computing units 08, together with their transverse connection, as well as further, but not represented, computing and data processing units, form a so-called management level 11, or press management level 11 of the printing press 01. It has, for example, a signal connection 12 with, for example, at least one computing and/or data processing unit 13 of the product planning system 03. At least product-relevant data are transmitted via this signal connection 12 from the product planning system 03 to the printing press 01.

In a suitable manner, the printing press 01 is in a signal connection 15, 16 with the roll supply system 02, for example via the material flow system 05. Production-relevant data are transmitted from the printing press 01 to the material flow system 05, for example to at least one computing and/or data processing unit 17, at least via the

signal connection 16 between the printing press 01 and the material flow system 05. In addition or alternatively a transfer can also take place via an optional signal connection 20 from the product planning system 03. In principle, the material flow system 05 can also be assigned to the roll supply system 02 or the printing press 01 or, in an advantageous embodiment can be of a higher order in respect to these two - within the framework of its tasks -.

A possible configuration, based on hardware technology, of a roll supply system 02 is schematically represented in Fig. 2 wherein, however, in a device in accordance with the invention and/or for the method in accordance with the invention not all of the subsystems described hereinafter need be provided, and the individual functional subsystems can be embodied in a way different from the one shown.

In the exemplary embodiment in accordance with Fig. 2, the roll supply system 02 has, as subsystems 18, 19, 21, 22, 23, 24, 26, 27, 28, 29, 30, a material receiving device 18, a first transport system 19, a first storage facility 21 (possibly with its own transport system 22, such as a shelf-servicing device, crane or automatic guided vehicle (AGV), for example a main storage facility 21, a preparation circuit 23 with at least one transport system 24, a second storage facility 26, for example a daily or production storage facility 26 (possibly with a transport system 27, such as a shelf-servicing device, crane or automatic guided vehicle (AGV), as well as a transport system 31 between the daily storage facility 26 and the roll changers 06 of the printing press 01. In addition, a so-called up-ending station 30 for up-ending of rolls delivered and/or stored in an upright

position into the position required for production can be provided. The last mentioned transport system 31 of the roll supply system 02 is embodied, for example, as an inner loading circuit 31, which is to be assigned to the printing press 01 or the roll changer 03. The preparation circuit 23 has, for example, at least one unpacking station 28, as well as a gluing preparation device 29. Transport tracks 32, 33 for the return transport of empty rolls or their reels, and/or pallets can optionally be provided.

However, as a minimum requirement the roll supply system 02 can also merely have one of the storage facilities 21, 26 with a transport system 22, 27, and the transport system 31 between the storage facility 21, 26 and the roll changers 06 of the printing press 01.

In the simplest case the material receiving device 18 consists of a delivery position to the automatic roll supply device and an input possibility for the roll entry information. However, optionally it is advantageous to perform unloading from a truck, train or ship not by means of the forklift, but to automate it. Here, three basically different models can be distinguished: a) prone transport of the paper rolls and rolling the rolls via the circumference, b) upright transport of the rolls on a truck/railroad car/ship with rails on the bottom, c) upright transport of the paper rolls on a special truck/railroad car/ship which has a sort of conveyor belt on the loading surface.

A roll separating device can be assigned to the material receiving device 18. As a rule, rolls of half or quarter width are transported upright on top of each other. In this case it is necessary to separate the rolls, i.e. to

lift off the upper roll and place it at the side of the lower one.

Damage can occur in an automatic system if the material to be transported does not correspond to the expected shape. It is therefore practical to check the keeping of the outer shape within defined tolerances and to additionally assign a contour control device to the material receiving device 18. In connection with paper rolls, systems with photoelectric barriers, photoelectric grids or surface scanners can be considered, to which a more or less intelligent evaluating device is connected.

It is furthermore advantageous if the delivered roll is identified in the area of the material receiving device 18, for example by detecting a bar code or by means of another system. The bar code strip is used for identification of the roll and is detected by the system.

For the upright storage of packaged paper rolls, for example, the main storage facility 21 is embodied as an elevated shelf storage device 21 with several storage compartments in several blocks and on several levels. The elevated shelf storage device 21 can also be able to receive pallets. It should be of a capacity sufficient for being able to receive the amount of paper required for up to eight weeks. If for example the rolls are stored upright in the main storage facility 21, the up-ending station 30, for example, adjoins the main storage facility 21, before the roll gets into the preparation circuit 23.

As a rule, a preparation circuit 23 consists of an unpacking station 28 and a gluing preparation device 29 embodied as an automatic gluing preparation device. Added to

this are transfer positions for the respective transport system 24. For example, the unpacking station 28 has means on which the paper rolls can be aligned and unpacked semi-automatically. Furthermore, the bar code can be detected for example by means of a hand scanner for checking, the diameter determined and the roll can we weighed for a check. For example, the gluing preparation device 29 represents an automatic gluing preparation system. A suitable gluing preparation can prepare approximately 15 rolls in an hour, for example.

The daily storage facility 26 is used for receiving paper rolls which had been prepared for production or had been returned from the roll changers 06. It should be noted that the glue preparation lasts only for a limited time, at present 8 to 12 hours, for example, and must then be renewed. It is possible that roll remnants on loading aids which were returned from a roll changer 06, as well as loading aids must be handled in the daily storage facility 26.

A roll changer 06 has, for example, two pairs of support arms for receiving paper rolls. A portion of a conveying track is assigned to each roll changer 06, on which a paper roll can be presented to the roll changer 06. The roll changer 06 with its buffer position (receiving space) is also called an inner loading circuit 31 and is a part of the printing press 01, or is assigned to it. It is used for rolling off the paper rolls and for automatic roll change with gluing.

As already mentioned above, as a rule there are several different transport systems 19, 22, 24, 27, 31 for transporting the paper rolls. If the roll is stored in an

upright position in one or several storage areas, or if the rolls are delivered upright, an up-ending station, not represented, can also be required. For transport over extended horizontal distances such as, for example, between the material receiving device 18 and the storage facility 21, plate or belt or plate conveyors are employed, for example, which function similar to a conveyor belt. In a storage facility 21 embodied, for example, as an elevated shelf storage device 21, shelf-servicing devices 22 are employed as transport systems 22. For storage facilities 21, 26 of up to three levels embodied as shelf-storage facilities 21, 26, and for distance transporting, transport systems 19, 22, 24, 27 embodied, for example, as driverless floor conveying devices 19, 22, 24, 27, can also be employed. Track-bound transport systems 23, 31, for example, driven track-bound transport carriages with appropriate guide devices, for example, are employed for the roll transport within the preparation circuits 23 and in the inner loading circuits 31. In small to medium-sized installations the entire roll transport can be provided by means of track-bound transport carriages.

The movement control of each of the transport systems 19, 22, 24, 27, 31 is provided by a control device 34, 35, for example a memory-programmable control device 34, 35, in particular a configurating SPS (including operating panel, by means of which transport orders can be configured), assigned to this transport system 19, 22, 24, 27 or, in an advantageous embodiment, a computer unit 34, 35 assigned to this transport system 19, 22, 24, 27, 31, for example a vehicle guidance computer 34, 35 (see Fig. 3 in this connection). The control device 35 of the inner loading

circuit 31 and/or roll changer 06 represents, for example, an interface between the roll supply system 02 and the printing press 01, which can be assigned to one or the other system, depending on the considerations and embodiment.

In a high-performance printing press with, for example, cylinders of double circumference, i.e. a circumference of 900 to 1300 mm which, depending on the format, corresponds to two section lengths (for example heights of a newspaper page), approximately 90,000 pieces are produced, for example, during double production, and approximately 45,000 pieces during collect-run production. If approximately 18,000 m of paper are rolled up on a roll, a roll will be used up, for example, in approximately 15 to 20 minutes. Approximately 4 to 7 min must be set aside for roll change, acceleration, gluing and reel ejection.

The roll supply system 02 must be capable of supplying a printing press 01 with one or several lines of presses, each of which consists of several sections A, B, sufficiently with prepared paper rolls. Thus, for example, there can be a requirement of approximately 60 rolls per hour during the production times (at night as a rule). Filling the daily storage facility 26 and preparing the rolls can take place, for example, during times of low production (for example during the day).

The roll supply system 02 must furthermore be capable to meet roll orders and return orders from roll changers 06. It is also desirable to determine the actual paper requirements by means of production data provided by the production planning system 03, for example also on the basis of actual press parameters actually provided by the press

management level 11. Moreover, "desired" production data should be taken into consideration during the running production.

For meeting the mentioned requirements, the print shop has the material flow system 05 for planning, coordinating and controlling the material flow in the print shop. In an advantageous embodiment, the material flow system 05 controls and maintains the entire flow of material in the installation and is of a higher order than the subsystems of the roll supply system 02. Besides the direct roll supply, it contains for example the handling of the material receiving device 18 and the maintenance of the storage facility 21, 26. If the storage facility 21, 26 is designed with its own storage maintenance system in the form of a subsystem, the material flow system 05 has at least one interface with this subsystem.

The material flow system 05 is shown by dashed lines in Fig. 3. The material flow system 05 receives information regarding planned and running productions from the higher-level product planning system 03, for example via the signal connection 16, or from the printing press 01, in particular the management level 11 of the latter. These data are processed in the material flow system 05 in a way to be explained in greater detail below. The mentioned lower-order subsystems of the roll supply system 02, or of the printing press 01, each of which performs strictly limited functions, are available inter alia to the material flow system 05 for the material transport, the roll preparation and supplying the press. For this purpose the material flow system 05 has a signal connection 15 to the subsystems required for the

flow of materials. In the simplest case of the roll supply systems 02 these can merely be one of the storage facilities 21, 26 (possibly with the transport systems 22, 27) and the transport system 31 from the storage facility 21, 26 to the roll changer 06. However, the material flow system 05 has been represented as a process chain together with all above mentioned subsystems in Fig. 3.

Viewed in respect to the process, two different process levels 38, 39 of the material flow system 05 itself are shown, namely a planning level 38 and a coordination level 39, which work together with a third process level 41, the execution level 41, constituted by the subsystems.

Here, the planning level 38 is responsible for calculating consumption, storage and supply strategy in relation with the planned production, for monitoring functions, and the storage and supply management. It has interfaces with the coordination level 39 and, if required, with non-system data sources (such as for receiving electronic delivery data or delivery documents from suppliers, for example) and data sinks (such as the delivery of use data to a data bank, for example). The planning level 38 can start with its work before the coordination level 39, or the subsystems of the execution level 41, are ready to operate or are still handling other orders. It could happen that continuously re-occurring productions (for example a defined newspaper or magazine) are already planned weeks and months ahead of time. Since the planning level 38 has data regarding the stock available, a decision is made there when the need occurs whether and which replacement roll is to be used in place of a lack of a required roll.

The coordination level 39 is responsible for the run-off control, transport control, movement control, safety monitoring and storage place management. Strategies are employed here for optimizing the resources for the transport and the cycle times. The coordination level 39 receives information from the planning level regarding where and in which time window which paper, or which roll, is required, and coordinates the lower-order subsystems of the execution level 41 for assuring the supply of the production under the conditions of the framework mentioned. As a rule, the time window to which the work of the coordination level 39 relates includes a night or a production day. However, in some cases this time window can be expanded to as much as a week.

The execution level 41 as the third process level 41 consists of a number of the above mentioned self-sufficient subsystems, each of which strictly limited functions. As a rule, these subsystems each consist of a mechanical device and the control 34, 35, with which the coordination level 39 has an interface. In most cases the subsystems of the execution level 41 do not communicate directly with each other, but instead via the coordination level 39. On the execution level 41 each subsystem only sees its actual mission. After this has been performed, the next mission can be forwarded from the coordination level 39. Depending on the subsystem, these missions can be of different complexity. Exceptions to the exclusive interface with the coordination level 39 only exist, for example, in connection with hardware contacts for safety, or back-up operations, as well as in the inner loading circuit 31 which, for example, is embodied as a branch channel with carriages extending from

the transport system 27 and acts together with a sliding platform, not represented, and the support arms of the roll changer 06. In the last mentioned subsystem automatic movements change into each other, wherein the function for supplying the printing press 01 must also be assured when the higher-order systems, such as the material flow system 06 or a part thereof, for example, have failed. Therefore the roll changer 06 must be in operative connection with the control of the printing press 01, as well as with the roll supply system 02.

Since the various process levels 38, 39, 41 can operate independently of each other to a large extent (semi-autonomous), it is advantageous to provide a required exchange of data on the process level 38, 39, 41 where the data are needed. It is important for the fail-safe operation and the availability of the entire installation in particular that information is actually being handled at the place where it is processed. Besides this it is also of particular advantage that no unnecessary data traffic takes place over the connections between the individual process levels 38, 39, 41 which, for example, would relate to the regulating or control process of the individual subsystem itself. Each system or subsystem receives its orders, processes them and reports back in accordance with the (interim) result.

The planning and the coordination levels 38, 39 can be designed as separate processes on a common computing and/or data processing unit 17, for example a server 17, or on two servers 17 connected with each other. However, the sub-systems of the execution level 41 are each individually embodied and can be provided as different models from

different suppliers, in the same way as the systems of the printing press 01.

In an advantageous embodiment, a framework of conditions for the data to be exchanged has been determined for the communication between the printing press 01, or the managing level 01 and/or product planning system 03 with the material flow system 05, and in particular between the material flow system 05 and the associated subsystems.

The functional units, as well as the data flows required for automatic roll supply, are represented in Fig. 4. Although for this representation the roll storage facilities 21, 26, as well as the transport systems 19, 22, 24, 27, were combined as functional units, they communicate substantially individually as functional units with the communications level 39 as described above. Although the order (if given) and the acknowledgement of the preparation circuit 23 (if provided) can also take place over this path, the preparation circuit 23 is again explicitly shown as a functional unit, from which the coordination level 39 receives roll data, for example. The same applies to the material receiving device 18 (if provided) in respect to material reception data, as well as to the inner loading circuit 31 in respect to a request for material. As a further functional unit, the roll changer 06 exchanges data with the coordination level 39, for example in respect to actual rolls or those to be requested or to be returned, and is additionally connected (as already explained above) with the inner loading circuit 31 in respect to data.

Not all data flows represented are absolutely necessary for the basic functionalities of the roll supply system 02 or

the material flow system 05. However, the intentions are to automate the paper supply as a whole and to integrate it into a computer-supported work flow.

The most important data sources and data sinks are the management level 11, from which the actual production data, such as press rpm, desired circulation, actual circulation, etc., are received, the product planning system 03, which supplies the product layout, the type of paper, the roll widths, the roll supports involved and the planned production date, as well as the roll changers 06 or sliding platforms of the inner loading circuit 31, by means of which the production is realized.

Here, the data flows merely show the logical path of the data. Control flows and the physical transfer medium cannot be seen in this representation. Data flows which are without importance here for the flow of material (for example between the roll changer 06 and the press management level 11) are not shown. Since this relates to the data interfaces of the material flow system 06 with the "outside", the internal data flows between the planning level 38 and the coordination level 39 are not examined in detail.

The same as with the previous process chain in Fig. 3, the communication with external systems (press management level 11, product planning system 03, exporting of user data, importing of delivery or roll input data) thus takes place via the planning level 38, while the data exchange with the lower-order subsystems is performed via the coordination level 39.

In what follows, the essential data to be transferred via the mentioned data interfaces will be defined.

In the case where the total system has an appropriately equipped material receiving device 18, the information regarding an arrival of a roll is provided by the material receiving device 18 with at least standardized information regarding the geometry of the roll, as well as the quality of the paper. This information from the manufacturer is preferably contained in a bar code assigned to the roll, for example Ifra-, Cepi- or Tappi-code.

By using the Ifra-code, data regarding the roll number (paper machine number and production week, as well as roll ID or the reel number with the corresponding reel set and position in the reel), the gross weight of the roll, type of packaging, manufacturer, paper type (basis weight and quality in the form of a code), as well as the manufacturer's code, for example, are transmitted. By using the Tappi code, the manufacturer's code, manufacturer's location, paper machine, year of manufacture, month of manufacture, day of manufacture, reel of the day, radial position of the paper on the reel, as well as the horizontal position of the paper on the reel, for example, are transmitted.

In addition to the data supplied by the manufacturer by means of the bar code, parameters detected in the area of the material receiving device, such as "roll width", as well as "roll status" (type and depth of damage), can be transmitted.

For the case where the installation either does not have a material receiving device 18 designed in this way, or in addition to the data received from the material receiving device 18, the above mentioned data from the bar code can also be read out in the preparation circuit 23 and supplied to the material management system 05. In addition, data

regarding, for example, the gross weight of the rolls, the gross weight of the white waste, the net weight of the rolls, the roll width, as well as the roll diameter are determined here and passed on to the material management system.

Important data relating to the roll, such as in particular its length (or remaining length in case of returns) and roll width, as well as the paper type, or roll IDs containing equivalent information, or bar code information and status information, are exchanged between the roll changer 06 and the material management system 05. Additional advantageous information relates to, for example, the winding direction, diameter, weight and basis weight. Further data specific to the supplier, such as information regarding the geometry, the weight, supplier identification, IFRA code, material number and batch number, for example, can be exchanged. The data composed of some or all of the mentioned information are combined here and in Fig. 4 under "reel data", for short.

The material flow system 05 receives the planning data required for planning of the material flow for pending (and possibly running) productions from the production planning system 03. This includes, beside a product recognition, for example a product ID, the information essential for determining the requirements, the time windows and the user locations, such as the planned number of copies, for example, the planned time for a proof copy, the planned imprinting time, as well as the planned type of production. Information regarding the number of planned webs, with corresponding information regarding the paper (width, assigned roll changer), as well as the total number of pages, product name,

planned publication date, as well as the name of the issue, can be advantageously added to this.

If no suitable interface between the product planning system 03 and the material flow system 05 has been provided, the mentioned data can also sent by the product planning system 03 to the material flow system 05 via the management level 11 of the printing press 11.

The material flow system 05 receives data from the management level 11 regarding the production itself, the actual status of the running production, as well as the geometry and type of paper and their relation with the roll changers. In addition, information regarding the product itself, such as the production ID, product name, publication date, name of the issue and number of copies, can be transmitted.

The data regarding the production can be section identification, type of production, time for a proof copy, imprinting time and production status. For example, the actual status contains information regarding the intended number of copies, number of printed products, number of products suitable for sale, the status of the printing press, production speed, as well as a time stamp.

Information regarding the type of paper consists, for example, of a paper identifier, the basis weight and possibly the paper thickness. The relation between the paper and the roll changers 06 includes for example the identification of the roll changer 06, the assignment of the paper (for example a paper ID) and information regarding the width.

The material flow system 05 can transmit outage reports, for example information regarding failed portions of

the installation, and information for pin-pointing the error, to the management level 11.

As explained above, the material flow system 05 communicates in the area of its coordination level 39 with the transport systems 19, 22, 24, 27, 31, or storage facilities 21, 26. This communication takes place in a similar way for the individual subsystems mentioned and is treated here as a whole. The material flow system 05 directly addresses the respective transport systems 19, 22, 24, 27, 31, or storage facilities 21, 26 and transmits a bring-or-fetch order. Since in an advantageous manner the material flow system 05 also includes the management of the storage spaces, in particular in the area of its coordination level 39, information regarding the starting point and the point of destination are transmitted to the respective transport system 22, 27. Although, in an advantageous embodiment, the storage facilities 21, 26 and/or the transport system 22, 27 do not have a storage space management device, they have a space monitoring device, i.e. monitoring whether a space, and possibly which one, is free or occupied. If the storage space management device is embodied as an individual subsystem between the storage facilities 21, 26 and the material flow system 05, the placing of a secondary order to the latter is necessary which, however, would entail an increased outlay for communications.

Each of the mentioned transport systems 19, 22, 24, 27, 31, or storage facilities 21, 26 confirms its status to the material flow system 05 - either in fixed cycles or at the latest after the termination or failure of the order -.

To complete the picture, the transfer from the product planning system 03 to the management level 11 will also be mentioned. In addition to planning data already mentioned within the framework of the transmission from the product planning system 03 to the material flow system 05, it contains all data essential for the configuration and presetting, such as color preset, web tension preset, sections, print locations, occupation, etc.

The data for the respective data interfaces, which must be transmitted without fail, are combined in the following table:

Material receiving device 18 —> MFS 05	- Roll ID - Roll width - Data from Ifra code, in particular weight
Preparation circuit 23 —> MFS	- Roll ID - Net weight
Roll changer (RC) 06 —> MFS (transport-relevant data and/or those relating to the status of the roll changer)	- Status of the RC position - Roll ID - Actual diameter of the active roll - Requesting a roll
MFS —> roll changer (RC) 06	- Roll ID

Product planning system 03 —> MFS (production-relevant data, planing data)	- Planned roll changer 06 - Planned or desired issue - Size of the product (number of pages) - Planned type of paper
Management level 11 —> MFS (production-relevant data, data relating to the actual status)	- Production speed - Actual net issue, actual gross issue - Desired issue
Transport system/storage facility —> MFS	- Status of the transport system/storage facility - Roll ID
MFS —> subsystem (transport system/storage facility)	- Order or transport order

An important aspect of the mentioned processes and data flows therefore is that a product-related data set, which characterizes the planned or running product and is stored in the computing and/or memory unit 13, or in the management level 11, is supplied via the fixed signal connection 16, 20, etc., to the material flow system 05 for further processing. It is neither necessary for the printer to manually provide a usage prognosis, nor is such a one prepared in the area of the product planning system 03. In contrast hereto the material flow system 05 always accesses actually present data for developing and/or changing its

decisions or strategy. The transfer of all above mentioned tasks to the material flow system 05, which operates at a higher order in respect to the roll supply, and the access to data from the product planning system and/or the printing press 01 assures the highest amount of flexibility and dependability. The material flow system 05 is always in the actual state regarding the production requirements, the supply, as well as the status of its lower-order subsystems and the interface with the roll changer 06.

For example, the following actions are to be performed with the above described configuration of the roll supply system 02 and the corresponding data exchange:

- unloading a truck, together with the material receiving control and storage in the main storage facility 21,
- repositioning in the main storage facility 21,
- removal from an elevated shelf storage device 21 to an up-ending station 30 and up-ending a paper roll,
- transporting a paper roll to an unpacking station 28,
- passing a paper roll to a removal point between the daily storage facility 26 and the inner loading circuit 31, or directly to a roll changer 06,
- storing a paper roll in the daily storage facility 26,
- repositioning in the daily storage facility 26,
- monitoring the stability of the gluing preparation 29 in the daily storage facility 26,
- removal of a roll for repeating the gluing preparation 29,

- delivery of a paper roll to a transfer point of a roll changer 06,

- delivering a load assistance device or adapter to a roll changer 06 from receiving a roll remainder,

- return of paper rolls from the roll changer 06 (with or without adapter),

- transporting a container of a remaining reel from and to the roll changers 06,

- calculation and monitoring the paper requirements of the production with the aid of production data from the press management level 11,

- managing the storage space occupation and the stored supplies in the daily storage facility 26 and in the main storage facility 21,

- statistical evaluations and inventory,

- process visualization,

- acknowledgement of receipt of goods in electronic form (electronic delivery receipt),

- management of a possibly provided stacked layer storage/additional block storage,

- default filling the daily storage facility 26 on the basis of empirical values/preset values,

- automatic bar code detection,

- print-out of stock lists/protocols,

- graphic user interface with intuitive user guidance,

- standard functions of modern storage facility management.

The concept of the print shop with the material flow system 05, up to now produced from a technical processing and

data point of view, can be basically physically realized in different ways. The linkage or integration of the material flow system 05 to or in the network 09 of the printing press 01 and of the product planning system 03, as well as the data flow and the linking of the roll changers 06 and/or the inner loading circuit 31, are at the center of the following explanations. The connection 15 to the remaining subsystems 18, 19, 21, 22, 23, 24, 26, 27 (to the extent provided) is only shown by a number of two-headed arrows. In what follows, exemplary embodiments of an advantageous linkage will be explained, however, the above mentioned concept is not limited to these.

When linking the material flow system 05 to the printing press 01, a distinction can basically be made in accordance with two points of view. For one, a differentiation can be made whether the data exchange between the printing press 01 and the material flow system 05 takes place, besides the connection to the management level 11, via a separate connection to the roll changer 06 (or to the inner loading circuit), or whether the communication between the roll changer 06 (or the inner loading circuit 31) and the material flow system 05 takes place via the internal printing press network 09 and the control console level. Secondly, a distinction can be made whether or not a homogeneous network has been formed between the control device 35 of the roll changer 06 (or the inner loading circuit), the material flow system 05 and the control console level 11, i.e. a continuous connection based on the same protocol.

The physical linkage of the material flow system 05 to the printing press 01 and the product planning system 03 is

represented schematically in Fig. 5. Of the units of the printing press 01, only a single printing tower 04, a single folding apparatus 07, as well as a single roll changer 06 have been symbolically represented by dashed lines. These units 04, 07, 06 are in a signal connection, which is internal to the printing press, with each other and with the managing level 11 via an initially arbitrarily designed network 09 (homogeneously or heterogeneously)(only symbolically indicated by dashed lines).

In the first exemplary embodiment in accordance with Fig. 5, the material flow system 05 is for one in contact via a signal connection 42, which is different from the printing press-internal signal connection 09, with the control device 35 of the inner loading circuit 31 and/or of the roll changer 06. This control device 35 can also have two separate control circuits and/or be embodied in two parts, wherein a connection between the parts then exists, and/or both parts are connected with the signal connection 42. Besides this, the material flow system 05 is connected via a signal connection 43 with the management level 11 and the product planning system 03. The functions of the management level 11 and the product planning system 03 can also be designed structurally and possibly with respect to the software as one unit (indicated by dashed lines). Thirdly, the material flow system 05 is in a signal connection 15 with the further sub-systems (to the extent they are present and integrated) of the roll supply system 02. This embodiment of the architecture is distinguished in that the required communication between the material flow system 05 and the roll changer 06, or the inner loading circuit 31, is not

"dragged through" the printing press-internal network 09. The roll changer 06, or the inner loading circuit 31 receives and transmits the data regarding the production and the printing via the network 09, while the communication regarding the roll supply takes place via the signal connection 42. The embodiment of the connection 42 between the roll changer 06, or the inner loading circuit 31, and the material flow system 05 is independent of the embodiment of the interface, or the connection 43, with the managing level 11 and/or the product planning system 03.

The linkage of the material flow system 05 to the subsystems, to the managing level 11 and to the production planning 03 can basically take place via the individual interfaces and connections. In an advantageous embodiment, the connection takes place over a common network 43, to which the material flow system 05, the subsystems, the managing level 11 and the production planning 03 are linked as so-called clients. The network 43 is advantageously embodied in such a way that it is the same type as the interfaces of as many subsystems as possible, in the ideal case of all. The interfaces of the managing level 11 and of the production system 03 are of this type. In an advantageous embodiment, a random access method, in particular the access method standardized in accordance with IEEE 802.3, is used as the access method. In this case the network 43 is designed as an ether net, in particular of a bandwidth of 100 Mbit/s or more. Basically the communication can be based on the most varied protocols, but in an advantageous embodiment on the TCP/IP protocol or a socket connection.

For one, the mentioned design of the network 43 contains advantages in view of the speed of the data transmission. Then, it makes it possible to connect all, or at least most subsystems of the roll supply system 02 without the requirement for a conversion of the protocol (for example by means of a gateway, which would reduce the speed), since in an advantageous embodiment the subsystems (except for the roll changer 06, or the inner loading circuit 31) have an appropriately designed interface, in particular an ether net interface. This can also be provided for the roll changer 06 and/or the inner loading circuit 31. Thirdly, such a design of the network 43 makes it possible, when required, to start the data bank and/or the data set access through it without the additional implementation of a data bank client being necessary.

In general, in an advantageous embodiment the network 43 and the printing press-internal network 09 can be designed as networks 09, 43 of the same type in a common homogeneous network 09, 49 (with or without the formation of segments) with a common protocol family. This network 09, 43 can be designed in particular as an ether net, at least a fast ether net (or 100 Mbit ether net) of at least 100 Mbit/s, however, for insuring a low collision rate in the area of the printing press 01 in particular, as a gigabit ether net with 1,000 Mbit/s or more.

In another advantageous embodiment the network 43 and the network 09 are differently designed in accordance with their specific requirements. The printing press-internal network itself can possibly be additionally constructed

heterogeneously, access different protocol families and have one or more protocol converters, or gateways. In the present example, at least areas of the network 09, inclusive of the linkage to the roll changer 06 and the inner loading circuit 31, are embodied as a network 09 with deterministic access methods, in particular based on token passing, for example as an arcnet. Within the printing press 01 this assures the dependable transmission of time-critical data within dependable time windows, while excluding data collision to a large extent.

Since now there is a multi-protocol environment between the network 09 and the control device 35 of the roll changer 06, or the inner loading circuit 31, the connection of the roll changer 06, or the inner loading circuit 31, with the material flow system 05 has a protocol converter 44, or gateway 44 (dashed lines).

Because of the mentioned architecture, rapid communication of the material flow system 05 with the control console level 11/the product planning system 03, and the various subsystems is possible with little outlay.

In a second exemplary embodiment (Fig. 6) the linkage of the material flow system 05 to the roll changer 06, or the inner loading circuit 31 is provided not by its own connection 42, but via the signal connection 43 to the management level 11 and via the printing press-internal network 09. Because of the use of a network 43 which is different from the network 09, an intermediate connection of a protocol converter 44, or gateway 44 (dashed lines) is again necessary for this. The data relating to the handling of the rolls, or the roll supply, are here conducted through

the existing printing press-internal network 09. With this embodiment it is of advantage that existing paths can be utilized. Slowing caused by a greater network load and/or a greater risk of collisions must be accepted here, but can be reduced by embodying the printing press-internal network 09 as a fast, broad-band bus system with token passing, or as a rapid ether net, for example a gigabit ether net.

In a modification of the second exemplary embodiment, the linkage of the material flow system 05 in Fig. 7 does not take place directly via the network 43 to the managing level 11, but via the printing press-internal network 09. The data exchange with the roll changer 06, or the inner loading circuit 31, and the management level 11, or the product planning system 03 takes place here via the connection 42. If a protocol exists in the area of the connection 42 with the material flow system 05, or between the material flow system 05 and the lower-order subsystems, which is not suitable for processing in the material flow system 05 or the transmission to the subsystems, the arrangement of a protocol converter 44, or gateway 44, between the roll changer 06 and the material flow system 05 (not represented), or between the material flow system 05 and the lower-order subsystems (dashed lines), is advantageous. The connection between the material flow system 05 and the subsystems can be provided via respective individual interfaces, or a connection designed as network 46.

In a modification, further modification, the linkage of the material flow system 05 with the management level 11 in Fig. 8 does not take place via the printing press-internal network 09, but like a connection 47, different from the

printing press-internal network 09, with the network 43. In a multi-protocol environment between the network 09 and the network 43 the arrangement of a protocol converter 44, or gateway 44, between the network 43 and the material flow system 05 is provided. The data exchange with the roll changer 06, or the inner loading circuit 31 takes place via the connection 42. If a protocol exists in the area of the connection 42 with the material flow system 05, or between the material flow system 05 and the lower-order subsystems, which is not suitable for processing in the material flow system 05 or the transmission to the subsystems, the arrangement of a protocol converter 44, or gateway 44, between the roll changer 06 and the material flow system 05 (not represented), or between the material flow system 05 and the lower-order subsystems (dashed lines), is advantageous. The connection between the material flow system 05 and the subsystems can be provided via respective individual interfaces, or a network 46.

The remarks made in connection with Fig. 5 regarding advantageous embodiments of the networks 09, 43 should be analogously applied to the embodiments of Figs. 6 to 8.

List of Reference Symbols

01	Press, printing press
02	Material supply system, roll supply system
03	Product planning system
04	Printing unit, printing tower, unit
05	Control system, material flow system
06	Roll changer, unit
07	Unit, folding apparatus
08	Operating and computing unit
09	Signal line, network, internal to the printing press
10	-
11	Management level, press management level
12	Signal connection
13	Computing and/or data processing unit, server
14	-
15	Signal connection
16	Signal connection
17	Computing and/or data processing unit
18	Subsystem, material receiving device
19	Subsystem, transport system
20	Signal connection
21	Subsystem, storage facility, main storage facility, elevated shelf storage device
22	Subsystem, transport system, shelf-servicing device
23	Subsystem, preparation circuit
24	Subsystem, transport system

25	-
26	Subsystem, storage facility, daily storage facility
27	Subsystem, transport system
28	Subsystem, unpacking station (23)
29	Subsystem, gluing preparation device (23)
30	Up-ending station
31	Transport system, inner loading circuit
32	Transport track
33	Transport track
34	Control device, computing unit, vehicle guidance computer
35	Control device, computing unit, vehicle guidance computer
36	-
37	-
38	Process level, planning level
39	Process level, coordination level
40	-
41	Process level, execution level
42	Signal connection, connection
43	Signal connection, connection
44	Protocol converter, gateway
45	-
46	Connection
47	Connection, network
A	Section
B	Section